Marwadi University

Syllabus for Diploma Engineering

Electrical Engineering

Semester – I

Subject Name: DC Circuits

Subject Code: 09EE0101

Diploma Branches in which this subject is offered: Electrical Engineering

Objective: To prepare the students to have a basic knowledge in analysis of electrical circuit/network and to estimate value of voltage across or current through component of circuit/network. To solve the given circuit with various theorems and methods. To design charging and discharging of capacitors for various applications. To analyse magnetic circuit and differentiate magnetic and electric circuits.

Credits Earned: 6 Credits

Course Outcomes: After completion of this course, student will be able

1. To identify and differentiate various electrical components like resistor, inductor and capacitor etc.
2. To perceive significance of electrical components.
3. To compute current in different branches and voltage across the component using KVL and KCL theorem.
4. To apply different network theorem for calculation of unknown quantity (current, voltage) of electrical circuits and network.
5. To observe work of charging and discharging circuit for capacitor

Pre-requisite of course: Basic knowledge of physics i.e. electrical parameters and materials.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE	IA	CSE	Viva	Term work	
2	0	4	6	50	30	20	25	25	150

Contents:

Unit	Topics	Contact hours	Weightage (%)
1	**Basic Concepts of Electricity:** Introduction of electricity • Nature of electricity Modern electron theory • Structure of an atom • Charged body, Unit of charge, Free electrons Electric potential Electric current Electromotive force and potential difference Resistance • Laws of resistance, Resistivity, Specific resistance • Conductance, Conductivity • Multiple and submultiple units • Conductors, Semiconductors, and Insulators • Computation of resistance of metallic and composite Conductors • Effect of temperature on resistance • Temperature co-efficient of resistance • Effect of temperature on resistivity Source of electric energy • Dependent and independent sources • Basic concepts of voltage source and current source Ohm's Law Combination of resistance • Resistances in series • Resistances in parallel • Short and open circuits • Series-parallel combination of resistance Star-delta and delta-star transformation	3	11
2	**Work, Power and Energy** • S.I. Units • Definition work, power and energy and it's units • Electrical and mechanical work, power, energy, and efficiency • Thermal effect of electric current • Laws of electric heating • Thermal efficiency Relation between various quantities	2	7
3	**Electrical Circuit and Network Analysis:**	9	32

	Introduction Network terminology Kirchhoff's Law • Kirchhoff's current law • Kirchhoff's voltage law • Solution of network by kirchhoff's law Mesh analysis and nodal analysis of network • Maxwell's mesh / loop current methods Types of electric circuits • Linear, Non-liner, Active and passive network D.C. network theorems • Superposition theorem • Thevenin's theorem • Norton's theorem • Maximum power transfer theorem • Reciprocity theorem		
4	**Electrostatics and Capacitance:** Introduction • Static electricity • Electric charge Laws of electrostatics Electric field Electric lines of force Electric field intensity Electric flux and flux density Absolute and relative permittivity Coulomb's laws of electrostatics Electric potential, potential difference and gradient Potential at a Point Potential due to charge Dielectric strength Gauss's theorem Electrostatic induction Capacitor and capacitance Permittivity Capacitance of parallel plate capacitors Factor affecting capacitors Capacitance of multiplate capacitor Type of capacitors Capacitors in series, Capacitors in parallel Capacitors in series parallel Energy stored in capacitor Charging and discharging of capacitor Time constant	**5**	**18**
5	**Electromagnetism and magnetic Circuits:** Introduction	**4**	**14**

	• Magnet • Important properties of a magnet • Classification of materials • Law of magnetic force Law's and definitions • Pole strength • Laws of magnetism • Magnetic field • Magnetic lines of force • Magnetic flux • Magnetic flux density • Magnetic field strength • Magnetic force • Electromagnet, Electromagnetism • Reluctance, Permeance, Permeability • Intensity of magnetisation • Susceptibility Magnetic effect of electric current Current carrying conductor in a magnetic field Force between two parallel conductor Magnetic circuit • Important terms • Analysis of magnetic circuit • Comparison between magnetic and electric circuit • Composite magnetic circuits • Parallel magnetic circuit, MMF, Air gap • Flux, Leakage flux, Fringing Ampere turns calculation Series magnetic circuit and parallel magnetic circuit Analysis of series-parallel magnetic circuits B-H curve or magnetization curve • Magnetic hysteresis and hysteresis loop • Hysteresis loss, magnitude of hysteresis loss • Importance of hysteresis loop		
6	**Electromagnetic Induction:** Introduction Electromagnetic induction Faraday's laws of electromagnetic induction Direction of induced e.m.f. Induced E.M.F. • Dynamically induced e.m.f • Statically induced e.m.f. • Co-efficient of coupling Self-inductance, mutual inductance	**5**	**18**

	Mutually induced e.m.f. Expression for self and mutual inductance Inductances in series and parallel Energy stored in a magnetic field Losses in magnetic circuits Rise and decay of current in an inductive circuit		

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyse	Evaluate	Create
20%	20%	30%	15%	10%	5%

Suggested List of Experiments:

Sr. No.	Unit No.	Name of Topics	Contact Hours
1	1	To measure various electrical quantities like Voltage, E.M.F, Current, Power and Energy in a given electrical circuit	2
2	1	To measure and compute resistance of given material	2
3	1	To study of conductors, Semiconductors & Insulators	2
4	1	To analyze the effect of temperature on conductivity and resistance of a given material	2
5	1	To verify Ohm's Law	2
6	1	To connect resistances in parallel and series to measure required effective resistance	2
7	1	To perform star to delta and delta to star conversion	2
8	2	To study of unit conversion of electrical power and energy to other non-electrical energy and efficiency	2
9	2	To observe thermal effect of electrical current	2
10	3	To perform an experimental check of Kirchhoff's Current Law and Kirchhoff's Voltage Law	2
11	3	To perform experiment of Superposition Theorem.	2

12	3	To perform experiment of Thevenin's Theorem.	2
13	3	To perform experiment of Norton's Theorem	2
14	3	To perform experiment of Maximum Power Transfer Theorem.	2
15	4	To perform experiment of Coulomb's laws of electrostatics	2
16	4	To connect capacitor in series and parallel to measure required effective capacitance.	2
17	4	To perform experiment of charging and discharging time constants of capacitor	2
18	5	To measure magnetic flux of magnetic circuit	2
19	5	To perform experiment of B-H curve or magnetization curve	2
20	6	To perform experiment of faraday's laws of electromagnetic induction	2
21	6	To Perform experiment of rise and decay of current in an inductive circuit	2

Instructional Method:

a. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.

b. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.

c. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.

d. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

References:

1. B. L. Theraja, "*A Text Book of Electrical Technology Vol-I*", S. Chand & Co. Ltd., 2014

2. Tarlok Singh, "*Fundamental of Electrical Engineering*", S. K. Kataria & Sons, 2012
3. J. B. Gupta, "*A Course of Electrical Technology Vol-I*", Kataria & Sons, 2012
4. S.K. Sahdev, "*Fundamentals of Electrical Engineering & Electronics*", Dhanpat Rai & Co. LTD., 2014
5. U. A. Bakshi & V. U. Bakshi, "*Basic Electrical Engineering*", Technical Publication Pune, 2012
6. U. A. Patel, "*Elements of Electrical Engineering*", Atul Prakashan, 2016

Supplementary Resources:

1. http://nptel.ac.in/courses/108108076/
2. http://nptel.ac.in/downloads/108105053/
3. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-002-circuits-and-electronics-spring-2007/video-lectures/
4. http://www.electrical4u.com/nature-of-electricity/
5. http://vlab.amrita.edu/index.php